

REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 18-28 are pending in the present application. No claims have been amended, canceled, or added by the present response.

In the outstanding Office Action, Claims 18-28 were rejected under 35 U.S.C. § 103(a) as unpatentable over Takeshi et al. (Japanese Patent Application No. JP 2002-299607, herein "Takeshi") in view of Hamanaka et al. (U.S. Patent No. 6,548,421, herein "Hamanaka") and/or Tanaka (Japanese Patent Application No. JP-102966), which is respectfully traversed for the following reasons.

Briefly recapitulating, independent Claim 1 is directed to a method of manufacturing a semiconductor device. The method includes forming an amorphous insulating layer containing metal, silicon, and oxygen on a substrate, and heat-treating the amorphous insulating layer in a non-oxidizing atmosphere. The amorphous insulating layer has a surface region and a substrate side remnant region. The surface region includes nitrogen of a first concentration, which is 15 atomic % or more, and the remnant region includes nitrogen of a second concentration, less than the first concentration.

The method permits a solid-phase growth to take place to form an epitaxial crystalline insulating layer in the substrate side remnant region of the insulating layer while the surface region of the insulating layer remains amorphous. This phenomenon of having the same initial amorphous insulating layer transformed into two layers with different crystallizations is a result of the nitrogen concentrations in the surface region and the remnant region of the insulating layer, as disclosed in the specification at page 14, lines 18-25.

In other words, by providing the first concentration of nitrogen of 15 atomic % or more only in the surface region of the insulating layer and a lower concentration in the

remnant region results in the surface region of the insulating layer remaining in the amorphous state and the remnant region experiencing a solid-phase growth to form the epitaxial crystalline insulating layer when heat-treatment is applied. As noted in the specification at page 12, line 16, to page 13, line 8, this split of the initial amorphous insulating layer has the unexpected results that a resistance to impurities of the insulating layer is increased concurrent with achieving a high thermal stability of the insulating layer.

It is noted that the specification specifically discloses at page 14, lines 15-25, that the concentration of the nitrogen in the surface region of the insulating layer is 15 atomic % or more or otherwise “the film may possibly be crystallized in the process of high-temperature treatment of 1000°C or so while failing to sufficiently obtain the effect of adding nitrogen.”

The unexpected results obtained by the method of Claim 18 were discussed in the Declaration under 37 C.F.R. § 1.132 filed on December 20, 2005. Mr. M. Koyama, one of the inventors of the present invention, stated in that Declaration that layers similar to those disclosed by Takeshi were created and a surface region of the insulating layer having a nitrogen concentration of 13 atomic % crystallized based on his experiments, contrary to the method of Claim 18 which requires that the surface region of the insulating layer not to crystallize.

Applicants respectfully submit that the outstanding Office Action did not address the experiment section of the filed Declaration.

In addition, Takeshi discloses in paragraph 13 of the English translation that “it is desirable that a nitrogen content ... is more than 10 atomic % among said gate dielectric film.” Takeshi achieves the goal of preventing impurity diffusion by using a nitrogen content of 10 atomic % or more and the filed Declaration specifically indicated that a concentration below 15 atomic % (13 atomic % for example) fails to achieve the advantages of the method of Claim 18. Thus, Applicants respectfully submit that Takeshi was not aware of the

unexpected results of (i) using a nitrogen concentration of 15 atomic % or more for the purpose of preventing the diffusion of impurities through the insulating layer, and (ii) concurrently achieving a high thermal stability of the insulating layer.

In other words, although Takeshi discloses a value of 10 atomic % or more, Takeshi is not aware that a range of 15 atomic % or more will produce the unexpected results discussed above with regard to the method of Claim 18.

MPEP § 716.02 III states, in regard to unexpected results, that “[e]vidence of unobvious or unexpected advantageous properties, such as superiority in a property the claimed compound shares with the prior art, can rebut *prima facie* obviousness.” Thus, Applicants respectfully submit that the claimed method is not obvious over the method of Takeshi based on the unexpected results (i) and (ii).

Further, Applicants note that Takeshi forms a diffusion barrier layer 116 that includes nitrogen about 10 atomic % as disclosed in paragraph [0058] but does not teach or suggest that heat-treatment of layer 116 in a non-oxidizing atmosphere is either required or desired. Although the outstanding Office Action notes that Hamanaka or Tanaka disclose using a heat-treatment procedure, Applicants respectfully submit that there is no motivation or suggestion to apply the heat-treatment to layer 116 of Takeshi such that the surface region of layer 116 remains amorphous and the substrate region of layer 116 experiences a solid-phase growth to form an epitaxial crystalline layer as required by the method of Claim 18.

The outstanding Office Action provides at page 3, second full paragraph, a motivation to apply the heat-treatment to the structure of Takeshi. The provided motivation states that “such heat treatment step would **inherently** permit a solid-phase growth to take place in a region containing no nitrogen or low nitrogen in the amorphous insulating layer while remaining the nitrogen-containing surface region as an amorphous insulating layer ... (such

inherency is readily evidenced in the instant specification, such as page 16 therein)”
(emphasis added).

However, Applicants note that MPEP § 2112 IV states that “[t]he fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic.” Further, the MPEP states in the same paragraph that “[t]o establish inherency, the extrinsic evidence ‘must make clear that the missing descriptive matter is **necessarily** present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.’” (Emphasis added.)

In other words, the standard set forth by MPEP § 2112 IV with regard to establishing inherency is that the missing characteristic in the prior art is “necessarily” present in the prior art. The fact that the missing characteristic “may” be present in the prior art is not enough.

The outstanding Office Action did not establish that the heat-treatment disclosed either by Hamanaka or Tanaka necessarily produces the results recited by Claim 18. Further, it is noted that the outstanding Office Action relies on the specification of the Applicants to support the assertion that the applied art would produce the same results as Claim 18, which appears to be hindsight reconstruction.¹ The outstanding Office Action appears to combine the applied references based on the teachings provided by the claimed invention, which is improper.

In addition, Applicants respectfully submit that one of ordinary skill in the art would not combine the teachings of Takeshi with the teachings of Hamanaka and Tanaka because Takeshi teaches a MISFET that prevents the diffusion of impurities while Hamanaka teaches forming a silicide of a metal and Tanaka teaches reducing movable ions in a semiconductor device. These disparate reference teachings further raise a question of why the artisan would

¹ See MPEP 2141, stating, as one of the tenets of patent law applying to 35 USC 103, that “[t]he references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention.”

even consider these references for combination, a question the PTO must answer. See *In re Lee*, 61 USPQ2d 1430, 1434 (Fed. Cir. 2002), requiring the PTO to “explain the reasons one of ordinary skill in the art would have been motivated to select the references”

In other words, an attempt to bring in the isolated teaching of Hamanaka and Tanaka into the Takeshi method would amount to improperly picking and choosing features from different references without regard to the teachings of the references as a whole.² While the required evidence of motivation to combine need not come from the applied references themselves, the evidence must come from *somewhere* within the record.³ In this case, the record fails to support the proposed modification of the Takeshi method.

Accordingly, Applicants respectfully submit that independent Claim 18 and each of the claims depending therefrom patentably distinguish over the Takeshi, Hamanaka and Tanaka, either alone or in combination.

² See *In re Ehrreich* 590 F2d 902, 200 USPQ 504 (CCPA, 1979) (stating that patentability must be addressed “in terms of what would have been obvious to one of ordinary skill in the art at the time the invention was made in view of the sum of all the relevant teachings in the art, not in view of first one and then another of the isolated teachings in the art,” and that one “must consider the entirety of the disclosure made by the references, and avoid combining them indiscriminately.”)

³ *In re Lee*, 277 F.3d 1338, 1343-4, 61 USPQ2d 1430 (Fed. Cir. 2002) (“The factual inquiry whether to combine references ... must be based on objective evidence of record. ... [The] factual question of motivation ... cannot be resolved on subjective belief and unknown authority. ... Thus, the Board must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the agency’s conclusion”).

Consequently, in light of the above discussion, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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